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Popular Article

## Advances In Semen Extenders and Additives in Bovine Bull Semen Cryopreservation

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### INTRODUCTION

The objective of artificial insemination is to improve genetic merit of the bovine population. The most widely used technique for artificial breeding of cattle and buffalo requires a perfect medium to extend and preserve the semen ejaculates from elite bulls for the sake of exploitation of superior quality male germplasm to the maximum possible extent. The discovery of frozen semen was a major breakthrough in permitting long term preservation and transportation of semen of bulls of high genetic merit. In order to maintain fertilizing ability of spermatozoa for a long time, semen extenders and additives have been tested. Various components which combine to make semen extenders and semen additives are such that they possess all those properties which protect the viability, motility, fertilizing ability and longevity of spermatozoa or sperms in extended form during harsh ambient conditions and during cryopreservation or post thawed semen.

### Aim Of Adding Various Semen Extenders and Semen Additives

To prolong the viability, motility and fertilizing ability of spermatozoa without any harmful effects on spermatozoa. This will lead to better conception rate in females while maintaining other parameters (proper estrus detection, AI, proper feeding and management) in females in optimal levels.

**Caffeine** - The addition of glutathione or caffeine to BoviPro or EquiPro commercial diluents provided higher bovine's pregnancy rate in comparison to the egg yolk-based diluents (Fukui *et al.*, 2007).

**Butylated Hydroxy Toluene (BHT), Pentoxifylline (PTX) and Theophylline** - Butylated Hydroxy Toluene (BHT), Pentoxifylline (PTX) and Theophylline in extender improved sperm



cell function, such as motility, viability and acrosome integrity as compared to the control during liquid storage up to 48 hrs of preservation at refrigerated temperature (Fukui *et al.* (2007).

**Plant and animal protein free extenders** - Lecithin in various cryoprotectants takes care of sperm plasma membrane by restoring phospholipids which get lost during extension, cooling and cryopreservation and protect viability of cell.

**Bovine serum albumin (BSA) and Fetal calf serum (FCS)** - It increased the post-thaw total motility, linearity, lateral head displacement, straight linear velocity, average path velocity, viability, hypo-osmotic swelling test, total normal morphology and normal acrosome morphology.

**Glutathione, Taurine, Catalase, Glycine and Caproic acid** – These substances has defense functioning mechanisms against the lipid peroxidation of semen and important in maintaining sperm motility and viability.

**Melatonin:** Melatonin as well as its metabolites are indirect antioxidants and powerful direct scavengers that protected the sperm cells from the free radicals brought about by their metabolism (Kang *et al.*, 2009).

**Cysteine** - Cysteine has been shown to prevent the loss in motility of frozen–thawed bull semen.

**Curcumin and Dithioerythritol** - The addition of Curcumin and Dithioerythritol seemed to improve bull sperm motility during liquid storage or in the frozen state.

**Trehalose** - Trehalose added to semen extenders is known to improve the viability and motility of liquid or cryopreserved ram sperm.

**Vitamin B<sub>12</sub>** - The motility and straight-line velocity, curvilinear velocity and velocity of the average path values of bull sperm supplemented with vitamin B<sub>12</sub> were significantly higher than other concentrations (Hu *et al.* 2011)

**Vitamin C (Ascorbic acid) and E ( $\alpha$ -tocopherol)** - Vitamin E+C (1mg+5mM/ml) used with Tris-citric acid-Fructose egg yolk have mode of action in form of non-enzymatic antioxidants also the effects in from of, post thaw lower total sperm abnormalities and increase HOST % (Rao *et al.*, 2017).

**Iodixanol** - The iodixanol (2.5 %) in cattle and buffalo bull semen used with tris-egg yolk have mode of action in form cryoprotectant and also increase progressive motility and viability.

**Silymarin** - The silymarin used with tris-citrate-fructose egg yolk have mode of action in form of antioxidant property, stimulate rRNA and antioxidant enzymes.

**Oviductal proteins** - The oviductal proteins used with Tris-egg yolk-citrate increases motility, viability and acrosomal integrity of sperm cells.

**Cholesterol loaded cyclodextrins** - The cholesterol-loaded cyclodextrins used with tris-egg yolk-glucose have mode of action in inform of, restore lipid profile of sperm plasma membrane



also the effects in from of increase post thaw motility, viability index and improves stability of spermatozoa plasma membrane--reflected by decrease in seminal plasma ALP, ALT and AST activities.

## CONCLUSION

Different types of extenders and additives has been developed keeping the objective to maintain maximum fertility of spermatozoa during storage. By incorporating various types of semen additives and semen extenders for cryopreservation, significant improvement is reported in post thaw sperm quality in terms of increased % motility, viability, reduced DNA fragmentation and protecte the sperm cells from the free radicals brought about by their metabolism.

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